BULLETIN

OF THE INSTITUTE OF METALS

VOLUME 4 SEPTEMBER 1957 PART 1

INSTITUTE NEWS

Election of Members

The following 1 Overseas Sustaining Member, 31 Ordinary Members, 1 Junior Member, and 3 Student Members were elected on 25 July:

As Overseas Sustaining Member

OUTOKUMPU OY, Malminkatu 16, Helsinki, Finland.

As Ordinary Members

AUWÄRTER, Max, Dr.phil., Delegierter des Verwaltungsrates der Gerätebau-Anstalt, Balzers, Principality of Liechtenstein.

BEISSNER, Hans, Dr.-Ing., Betriebsleiter, Schweizerische Metallwerke Selve & Co., Thun, Switzerland.

BIRD, Philip Lorraine, F.R.I.C., Laboratory Manager of Chemistry Department and Leader of Metallurgy and Ceramics Group, Sondes Place Research Laboratories, Ltd., Dorking, Surrey.

BUNK, Wolfgang, Dr.rer.nat., Leiter des Laboratoriums, Aluminiumwalz- und Presswerke, Julius & August Erbslöh, Berlinerstr. 29–35, Wuppertal-Barmen, Germany.

CORSINI, Neri, Dr.chim.Ing., Via Pantano 2, Milano, Italy.

CROSS, Albert Henry Bantiff, B.Met., Ph.D., F.I.M., Chief Technologist, J. and J. Dyson, Ltd., Gripp Works, Stannington, Sheffield 6.

CUTHILL, John Robert, Ph.D., B.Sc., Physicist (Solid State), Metallurgy Division, U.S. National Bureau of Standards, Washington 25, D.C., U.S.A.

DUTANT, Marceau, Ing., Sous-Directeur de l'Usine, Chef des Fabrications, Société Cuivre et Alliages, Ham (Somme), France.

EVANS, John, Works Director, Higher Speed Metals, Ltd., Central Works, Brocco St., Sheffield 3.

GERHOLD, Ernest Alfred, Research Manager, Metallizing Equipment Company, Ltd., and Director, Metallizing (Metal Spraying), Ltd., Burrow Hill, Chobham, Surrey.

HEMINGWAY, John Henry, Commercial Director, Daniel Doncaster and Sons, Ltd., Penistone Rd., Sheffield 6.

HONKASALO, Jorma Bruno, Dipl.-Ing., Chief Metallurgist, Outokumpu Oy, Helsinki, Finland.

JACKSON, John Stephen, Ph.D., B.Sc., Research Metallurgist, British Thomson-Houston Co., Ltd., Rugby.

KUSSMANN, *Professor* Albrecht, Dr.phil., Direktor, Physikalisch-Technische Bundesanstalt, Leiter des Instituts Berlin, Abbestrasse 2–12, Berlin-Charlottenburg 2, Germany.

LAUE, Kurt, Dr.-Ing., Betriebsdirektor, Vereinigte Deutsche Metallwerke A.G., Hauptniederlassung Heddernheimer Kupferwerk, Frankfurt-am-Main—Heddernheim, Germany.

LOSMAN, Chaim, Ing.chim., Directeur, Société Gantoise d'Affinage S.A., Usine de Vilvorde, 200 rue Marius Duché, Vilvorde, Belgium.

MADSEN, Alan Rowland, Chief Metallurgist and Chemist, Pyrotenax, Ltd., Hedgeley Rd., Hebburn-on-Tyne.

MIKULLA, Hans Joachim, Dr.-Ing., Technisches Vorstandsmitglied, Busch-Jaeger Dürener Metallwerke A.G., Veldenerstrasse 63–65, Duren/Rhld., Germany.

MORLEY, John Ivan, A.Met., F.I.M., Chief Metallurgist and Special Director, Firth-Vickers Stainless Steels, Ltd., Staybrite Works, Tinsley, Sheffield 9.

NACKEN, *Professor* Matthias, Dr.-Ing.habil., Institut für Eisenhüttenwesen, Rheinisch-Westfalischen Technischen Hochschule, Intzestrasse 1, Aachen, Germany.

NAESER, Gerhard, Dr.-Ing., Mannesmann-Forschungsinstitut G.m.b.H., Ehingerstrasse 506, Duisburg-Huckingen, Germany.

NOWOTNY, *Professor* Hans, Dr.techn., Dipl.-Ing., Professor für physikalische Chemie, Technische Hochschule Wien, Getreidemarkt 9, Wien VI/56, Austria.

PARTHENIS, Alexander Xenophon, B.Eng., A.M.I.E.E., A.I.M., Senior Lecturer in Metallurgy, College of Technology and Arts, Rugby.

PYNNÄ, Ahti P., Dipl.-Ing., Tutkimusmetallurgi, Outokumpu Oy, Metallitehadas, Pori, Finland.

RICHMOND, Francis M., M.S., Met.Eng., Manager, Materials Research, Universal-Cyclops Steel Corp., Bridgeville, Pa., U.S.A.

SARMA, Sita Rama, B.Sc., Teacher, College of Engineering, Kakinada, India.

SAUTTER, Werner, Dr.rer.nat., Dipl.-Phys., Scientific Research Worker, Vereinigte Leichtmetall-Werke G.m.b.H., Bonn, Germany.

STIRLAND, Clive, Metallurgical Chemist, Dorman Long (Steel), Ltd., Cleveland Works, South Bank, Middlesbrough, Yorks.

TASTEVIN, Georges Anselme Theodore, Ing., Administrateur Directeur-Général, Société Cuivre et Alliages, 11 rue Godefroy-Cavaignac, Paris (11e), France.

TOFT, Leslie Howard, B.Sc., A.C.T.(Birm), A.I.M., Metallurgist, Research Laboratories, Central Electricity Authority, Randall's Farm Lane, Kingston Rd., Leatherhead, Surrey.

WATSON, *Lieutenant-Colonel* Nigel, O.B.E., Caterpillar Tractor Co., Ltd., Birtley, Co. Durham.

As Junior Member

JOSEPH, Günter, Ing.Civ.-Indust., Ingeniero, Corporación de Fomento de la Producción, Santiago de Chile, Chile.

As Student Members

HINDLE, Edward David, Undergraduate, Department of Metallurgy, University of Manchester.

LEHAN, (*Miss*) Margaret Harriet, Metallurgical Chemist, George Wimpey and Co., Ltd., Central Laboratory, Southall, Middlesex.

RAMSDEN, Gerald Edward, Undergraduate, Department of Metallurgy, University of Nottingham.

PERSONAL NOTES

MR. R. P. ABENDROTH has left the Missouri School of Mines and Metallurgy and joined the Metals Research Laboratories of the Electro Metallurgical Company, Niagara Falls, N.Y.

DR. B. B. ARGENT has been appointed Lecturer in Metallurgy in the University of Sheffield.

MR. F. E. ASBURY has left the Telegraph Construction and Maintenance Co., Ltd., and is now at the Research Laboratories of the Central Electricity Authority, Leatherhead.

MR. L. J. BALASUNDARAM has been appointed a Senior Scientific Officer in the Physical Metallurgy Division of the National Metallurgical Laboratory, Jamshedpur, India.

PROFESSOR M. BALICKI has taken up duties as an engineering specialist in the Department of Physical Metallurgy and Ceramics at the Sylvania-Corning Nuclear Corp., Bayside, N.Y. He was formerly Head of the Metallurgical Engineering Division at the Polytechnic Institute of Brooklyn.

MR. D. BINDLEY has taken up an appointment as Research Engineer at The Parsons and Marine Engineering Turbine Research and Development Association, Wallsend-on-Tyne.

MR. W. H. BOWMAN has left T.I. Aluminium, Ltd., and has been appointed to the board of High Duty Alloys, Ltd.

MR. F. P. BULLEN has left the University of Sheffield and is now a Scientific Officer in the Aeronautical Research Laboratories, Fisherman's Bend, Vic., Australia.

MR. D. L. COLWELL, Director of Laboratories, Apex Smelting Co., Cleveland, Ohio, has received an Award of Merit from the American Society for Testing Materials in recognition of his outstanding services to the Society.

MR. G. S. DEARNLEY has been appointed a Scientist at the Coal Research Establishment of the National Coal Board at Stoke Orchard, near Cheltenham.

DR.-ING. WALTER DEISINGER has been elected President of the Deutscher Normenausschuss.

MR. N. F. DEWSNAP has been appointed Senior Lecturer in Metallurgy at the Technical School, Port Pirie, South Australia.

MR. SVEN FORNANDER has resigned his position as Director of Research of Jernkontoret to become Technical Director of Surahammar Bruks AB.

DR. A. A. GOLESTANEH has left the British Welding Research Association and is now engaged in the laboratory of the General Electric Company, Erie, Pa.

MR. H. HAHN has left Columbia University and has taken a post in the Wright Aero Division of the Curtiss-Wright Corp., Wood Ridge, N.J.

MR. R. HARTMANN has been appointed Assistant Manager of the Metallurgical Development Department, Mallinckrodt Chemical Works, Uranium Division, St. Louis, Mo.

MR. I. M. HOW has left the Research Laboratories of The General Electric Co., Ltd., to join the staff of the Research Division, High Duty Alloys, Ltd., Slough.

MR. T. I. JONES is now employed in the Fuel Development Section of Atomic Energy of Canada, Ltd., Chalk River, Ont.

PROFESSOR COUNT BO KALLING has been awarded the Gold Medal of Jernkontoret in recognition of his contributions, extending over 40 years, to the Swedish iron and steel industry.

MR. J. F. LANCASTER has relinquished his position as Chief Metallurgist to the A.P.V. Co., Ltd., and joined the Kellogg International Corp., London, as Metallurgist.

MR. G. D. MCARDLE has left the Otis Elevator Co., Ltd., Hamilton, Ont., and is now a Research Associate in the laboratories of the Climax Molybdenum Company of Michigan, Detroit.

M. JEAN R. MARÉCHAL has been elected a member of the Académie des Sciences, Arts et Belles-Lettres de Caen.

MR. S. F. MARTON has left Sintered Products, Ltd., Sutton in Ashfield, and is now a Research Metallurgist on the staff of The Mond Nickel Co., Ltd., Birmingham.

MR. R. S. MOORE has left The Anti-Attrition Metal Co., Ltd., Maidenhead, to take up an appointment with Foundry Services (Overseas), Ltd., Birmingham.

MR. J. B. MOSS has been appointed Lecturer in Metallurgy at the North Lindsey College, Scunthorpe, Lincs.

PROFESSOR RUPERT MYERS, Head of the School of Metallurgy, New South Wales University of Technology, has been appointed Dean of the Faculty of Technology. He has also been re-elected a Member of Council of the University.

DR. J. A. ROBERTS has left the Research Laboratories of The General Electric Co., Ltd., and is now at the Fulmer Research Institute.

MR. N. A. WAGNER is now Chief Plant Metallurgist at the Richmond Extrusion Plant of Reynolds Metals Company, Richmond, Va.

PERSONALITIES

Dr. H. Harris

(Chairman, Scottish Local Section)

Born in 1902 and educated at the Grammar Schools of Accrington and Barrow-in-Furness, Herbert Harris received his scientific training at the Imperial College of Science and Technology, gaining the A.R.C.S. and B.Sc. (London) in 1922. After three years' post-graduate research, leading to

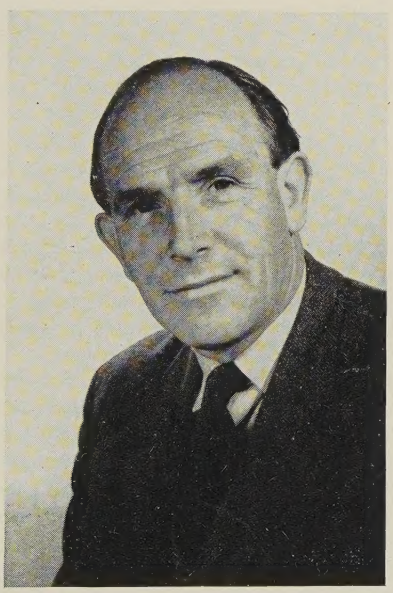
the Ph.D. degree (1925), he was appointed Lecturer in Physical Chemistry at Bristol University. Later he had industrial experience with the International Telephone and Telegraph

Laboratories, Inc., and the A.O. Smith Corporation in the U.S.A. before returning to Britain and joining Babcock and Wilcox, Ltd., in 1935. He is now Chief Metallurgist to the Company.

Mr. G. L. Hopkin, O.B.E.

(Chairman, Oxford Local Section)

Born in 1909, G. L. Hopkin graduated in metallurgy at the University College of South Wales and Monmouthshire in



1930. He joined the Research Department, Woolwich, as it was then called, and worked for several years on ferrous metallurgical problems associated with armament development. In the early days of the War, he led a team investigating the metallurgical problems of alloy steel welding; this work showed the important influence of hydrogen on the susceptibility of such steels to hard-zone cracking and led to the development of the now much-publicized low-hydrogen electrode. After the War he turned his attention to the metallurgy and arc-melting of molybdenum.

In 1950 he was appointed Superintendent of Metallurgical Research with the Atomic Weapons Research Establishment, and in 1954 he became Senior Superintendent of the Materials Division.

Mr. Hopkin is a Fellow of the Institution of Metallurgists and a Member of the Iron and Steel Institute, and he serves on several research committees of the British Welding Research Association. He was awarded the O.B.E. in 1953.

Professor R. W. K. Honeycombe

(Chairman, Sheffield Local Section)

Robert William Kerr Honeycombe was born in 1921 at Melbourne, Australia. He was educated at Geelong College

and the University of Melbourne, where he obtained the degree of Bachelor of Science in 1941, and Master of Science in the School of Metallurgy in 1942. From 1942 to 1947 he was a Research Officer in the Lubricants and Bearings Section (now the Division of Tribophysics) of the Commonwealth Scientific and Industrial Research Organization, where he carried out researches on bearings and wear and also on the plastic deformation of metals.

In 1947 he was awarded an I.C.I. Fellowship to the University of Cambridge to work in the Metal Physics Group in the Cavendish Laboratory, where he was concerned with research on the deformation of metal single crystals. In 1949 he was awarded the Royal Society Armourers and Braziers' Fellowship to continue this work. He obtained the degree of Ph.D. in 1950.

Dr. Honeycombe was appointed Senior Lecturer in Physical Metallurgy at Sheffield University in 1951, and there he helped to develop the Postgraduate School of Physical Metallurgy. In 1955 he was appointed to the Chair of Physical Metallurgy. At Sheffield his main research interests have been the plastic deformation of metals, precipitation in alloy steels, and the properties of thorium and its alloys.

Professor Honeycombe tries to keep a foot in two camps: he is allowed to talk to the metal physicists on one hand, but is also much stimulated by the problems of his industrial colleagues. He has not yet developed marked schizophrenia!

JOINT ACTIVITIES

Formation of the British National Committee for Non-Destructive Testing

In recent years the subject of the non-destructive testing of materials has achieved great importance. Societies have been formed with this as their main interest, while other Institutions of longer standing have devoted a more or less substantial part of their technical programmes to the discussion of non-destructive testing principles and techniques. At the beginning of this year a combined appeal was made by a number of societies to the Joint Committee on Materials and Their Testing to foster the establishment of a National Committee as a focus in the United Kingdom for all interest in this aspect of testing. The Joint Committee accordingly set up a Sub-Committee to examine this request and, as a result of its recommendations, it approved, on 18 June, the constitution, terms of reference, and rules for a committee which will be known as "The British National Committee for Non-Destructive Testing".

The formation, at this time, of a British National Committee for Non-Destructive Testing is of considerable significance, particularly in view of the coming International Conference in Chicago in November 1957. The need for a co-ordinating body has been clearly evidenced by the weight of the joint appeal for its formation, and by the widespread interest which has been shown in the exploratory discussions.

The Institute of Metals is a member of the Committee. The address of the Committee is c/o The Institution of Mechanical Engineers, 1 Birdcage Walk, London, S.W.1.

Report of B.N.E.C. Symposium on Calder Hall

At the B.N.E.C. Symposium on Calder Hall held in London in November 1956, 19 papers were presented which have been published in the April 1957 issue of the *Journal of the British Nuclear Energy Conference*. They cover all the important features of planning, design, and construction of the Calder Hall Nuclear Power Station, and the concluding paper deals with future developments of the gas-cooled power reactor.

The price of this issue is 7*s*. 6*d*. to members of the Institute, and copies may be obtained by sending a remittance to the Secretary, B.N.E.C., 1–7 Great George Street, London, S.W.1.

A full report of the discussion on the Symposium papers, together with the authors' replies, is published in the July issue, which is available at the same price.

NEWS OF KINDRED SOCIETIES

The Indian Institute of Metals

The Eleventh Annual Technical Session of the Indian Institute of Metals will be held in Bombay in December 1957. The programme will include a Symposium on "Rare Metals", which will be held concurrently with the Technical Session, in collaboration with the United Nations Educational, Scientific, and Cultural Organization and the Atomic Energy Establishment, Government of India.

The 4th Series of Educational Lectures, on "Phase Transformations in Steel", will be delivered at this Session, and the 4th Annual Metallographic Contest and Exhibition will also be held.

Any members of the Institute of Metals who may be visiting India at that time will be welcome.

OTHER NEWS

The Explosive Tendencies of Titanium and Zirconium *

All finely divided metal powders are dangerous, and the danger increases as the particle size decreases. Titanium and zirconium are specially dangerous in this respect. The ignition temperature of zirconium may be as low as 20° C., and that of titanium varies from 300° to 600° C. Dust, chips, turnings, and sponge of titanium and zirconium are, therefore, readily ignited by sparks or small flames. Accordingly, no sources of ignition should be permitted near dusty processes, the production of fine dust should be reduced as much as possible, good housekeeping should be used to prevent dust being disseminated, and the use of inert-gas atmospheres should be considered wherever practical. As dust will ignite in nitrogen or carbon dioxide, helium or argon should be used.

It should be noted that the words "zirconium" and "titanium" are often used to cover alloys based on these metals; it should not be assumed that incidents mentioned in this summary all refer to the unalloyed metals only.

Moist zirconium powder containing 5–10% water is particularly reactive. Thoroughly wet powder is much safer, as it is hard to ignite; once ignited, however, it will burn much more violently than dry powder. There is little doubt that the fire hazard is very great when dealing with zirconium. Apparently 70 tons of zirconium scrap have been burnt in a single fire, and there are grave doubts as to the advisability of storing zirconium turnings. An explosion occurred where dry zirconium scrap had been stored in drums under water, although there was a delay of five years before this happened. There is some indication that "zirconium" explosions are really hydrogen explosions, hydrogen being generated by the action of moisture on the metal. There is also an indication that a slight sprinkling of water, by rain or otherwise, may be dangerous, although complete immersion may be relatively safe.

The plans being made in the U.S.A. for the disposal of zirconium scrap already accumulated at various places are elaborate, and the greatest care is being taken to minimize vibration and shock during transport. It has been suggested that vermiculite should be used as insulation from shock and that personnel engaged in carrying the containers should wear aluminized-asbestos suits. As a measure of the danger that exists, in one situation it is proposed that the material should be loaded in containers on the fantail of a 78-ft. disposal boat and

* The Inter-Service Metallurgical Research Council asked its Corrosion and Electrodeposition Committee for a statement on the explosive tendencies of titanium and zirconium. As a result, Dr. U. R. Evans, F.R.S., prepared a fairly lengthy report based mainly on numerous documents received from the United States of America. This report has recently been published by the Ministry of Supply as Scientific and Technical Memorandum No. 5/57.

The account reproduced here is a summary of the report prepared by Mr. G. T. Harris, a member of the I.S.M.R. Council, with some additional information, based on documents received since the main report was written, supplied by the Secretary of the C.E.D. Committee.

transported some miles out to sea, each container being then pushed over the side by use of a long pole. Finally, the containers will be sunk by gun-fire. About 80 lb. is to be disposed of in this manner.

It is urged that " the quantity of zirconium powder should be kept to a bare minimum and in no case should be stored in anything bigger than a paint can of 1 gallon quantity within a polyethylene container. At least 20% by weight of water should be added to it. It goes without saying that the more zirconium metal powder involved in a fire, the greater the shock wave and the greater the heat liberated."

One of the main problems is the great difficulty of controlling or extinguishing titanium and zirconium fires. Water must not be used, as almost invariably a violent explosion will occur. Carbon dioxide is not effective, because finely divided titanium will burn in it. In some experiments it is reported that carbon dioxide seemed to stimulate the fire. Foam extinguishers are not effective, because of the large amount of water they contain, and carbon tetrachloride has not been effective on any of the test fires reported. The use of inert gases for extinguishing titanium fires deserves consideration, but clearly it would be successful only under conditions in which all air could be excluded.

A fire, once started, can be controlled by spreading certain dry powder compounds first around and then upon the burning pile. Calcium fluoride, graphite, and quicklime, which have been used for extinguishing uranium fires, would probably be suitable for dealing with titanium or zirconium. Dolomite has been recommended by one authority, but the fact that it will give off carbon dioxide raises certain doubts about its general suitability. It is understood that one form of dry powder extinguisher used in Britain for titanium fires is filled with powdered sodium chloride, each particle of which is coated with a layer of stearine to prevent clogging; a more recent form of extinguisher contains a different powder of undisclosed composition.

On the question of explosion in acids, it appears that zirconium and zirconium-rich alloys are dangerous even in dilute nitric acid, but that the hazard can be reduced by the introduction of ammonium bifluoride, although opinions differ as to whether such introduction can prevent explosions.

Explosions of a most serious nature have occurred with titanium in contact with red fuming nitric acid, and such contact must be regarded as dangerous, although the required conditions to cause an explosion will not necessarily occur. It is thought that the relative rarity of the explosions may be due to the fact that several conditions must *simultaneously* be fulfilled for their occurrence. These may be:

(1) Internal stresses in the titanium such as will expose a film-free surface more quickly than fresh film can be formed.

(2) Crevices where nitrous acid, a known catalyst in attack by nitric acid, can accumulate.

(3) Space where nitrogen oxides can collect, thus allowing dry oxidation; examinations carried out after large explosions provide evidence that the titanium has become molten locally, indicating the absence of liquid at certain places.

In all these cases, the compressional stresses believed to exist in those oxide films which thicken by oxygen moving inwards (in contrast with metal moving outwards) probably play a part; such stresses should normally increase the protective power of the films, if they are not too thick, but are likely to aid the collapse of the films under a shock wave.

It is recommended that all work using fuming nitric acid should be carried out under a hood with a shield between the worker and the flask. The worker should wear styrene gloves, a mask, and protective clothing. In view of the hazard involved in using fuming nitric acid, it is suggested that anybody handling it should make himself familiar with all the available literature.

Readers especially interested in " incidents " with zirconium should obtain a copy of U.S. Atomic Energy Commission Interim Report T.I.D. 5365: " Zirconium Fire and Explosion Hazard Evaluation ".

Symposium on Microchemistry, 1958

A Symposium on Microchemistry will be held in the University of Birmingham from 20 to 27 August 1958. This Symposium will be held under the auspices of the Society for Analytical Chemistry, and is being organized by the Midlands Section and Microchemistry Group.

It will consist of original papers and accounts of recent advances in microchemical techniques, presented by a number of chemists of international repute. The subjects will include: inorganic and organic qualitative and quantitative analysis, absorptiometry, chromatography, polarography, emission spectrography, radiochemistry, chemical microscopy, thermogravimetric analysis, biochemical methods, industrial applications, teaching, &c.

An exhibition of new and special apparatus will be held simultaneously, and visits to local places of interest will be organized. Registration forms and further information may be obtained on application to the Symposium Secretary: W. T. Elwell, F.R.I.C., I.C.I. (Metals Division), Ltd., P.O. Box No. 216, Research Department, Kynoch Works, Witton, Birmingham 6.

International Conference on Solid-State Physics in Electronics and Telecommunications, Brussels, 1958

The Postal and Telecommunications Group of the Brussels Universal and International Exhibition announces an international conference on Solid-State Phenomena in Electronics and Telecommunications to be held at the University of Brussels from 2 to 7 June 1958. The Universal and International Exhibition, in which 51 nations are represented, will be held in Brussels from April to October 1958.

Invitations have been sent to a number of outstanding scientists and engineers working in this field, and the Governments of several countries participating in the Exhibition have agreed to send official delegations.

Three main subjects will be treated at this conference: semiconductors, magnetic materials, and photo-sensitive and luminescent materials. Prospective authors of papers in the following fields are invited to notify the organizers as soon as possible:

(1) Preparation and properties of semi-conducting materials; the influence of crystalline imperfections on the properties of semi-conductors, diodes, transistors, and other semi-conductor devices and their applications.

(2) Ferrites, hexagonal oxides, and other magnetic materials; magnetic properties, supraconductivity, magnetic amplifiers, switching and microwave devices, masers and their applications.

(3) Radiation-sensitive materials, phosphors, electroluminescent materials, infra-red detectors, image amplifiers, light amplifiers, &c.

Preference will be given to papers dealing with basic investigations of solid-state phenomena which are related to potential applications in electronics and telecommunications, and with the development of apparatus and techniques based on recent progress in this field. Titles must be submitted not later

than 1 January 1958 and abstracts of some 500 words by 1 March 1958. The complete proceedings of the conference will be published in a special volume. The official languages of the conference will be English, French, and German.

All prospective authors and persons interested in attending the conference should write to the Hon. General Secretary, Société Belge de Physique, Loveral, Belgium. Further notices and programmes will be sent to these persons in due course.

Fifteenth Annual Pittsburgh Diffraction Conference

The Fifteenth Annual Pittsburgh Diffraction Conference will be held on 6, 7, and 8 November 1957 at the Mellon Institute in Pittsburgh, Pa. Sessions on radiation damage, semi-crystalline and amorphous materials, structure determinations, neutron diffraction, and instrumentation are planned. Provision for papers on general diffraction subjects will also be made. The meeting is to be a joint one with the American Crystallographic Association.

DIARY

The Institute

16–20 September. Autumn Meeting, Glasgow. For details see August *Bulletin* (pp. 189–190).

Local Section

12 September. Oxford Local Section. "Organization of Research", by Dr. J. H. Hollomon. (Cockcroft Hall, Atomic Energy Research Establishment, Harwell, at 7.0 p.m.)

APPOINTMENTS VACANT

ASSISTANT METALLURGIST of L.I.M. or equivalent standard, and having completed National Service, required for General Metallurgical Laboratory concerned with a wide range of materials and processes used in the manufacture of aircraft fuel systems. Work will include the investigation of failures and examination of raw materials. Applicants should have a sound knowledge of metallography, particularly of ferrous materials, and be able to work on own initiative. Applications to Personnel Manager, Joseph Lucas (Gas Turbine Equipment), Ltd., Shaftmoor Lane, Birmingham 28.

BRITISH THOMSON-HOUSTON CO., LTD.

The British Thomson-Houston Co., Ltd., has a vacancy in the Metallurgical Section of its Research Laboratory at Rugby for a graduate, preferably with some research experience. The work is concerned with research on the physical metallurgy of alloys and materials and their application to power plant, and offers excellent opportunities.

Applicants, not liable to National Service, are invited to write to the Director of Research, The British Thomson-Houston Co., Ltd., Rugby, stating age, qualifications, and experience, and quote reference OCG.

CHIEF METALLURGIST required for large repetition iron foundry group based on East Midlands. Steel foundry and light manufacturing also included. The responsibilities will be the direction and supervision of the existing routine control laboratories and the pursuance of an active programme of investigational and development work. The academic qualifications required are a good University degree or equivalent standing in the Institution of Metallurgists. Whilst knowledge of and some practical experience in the foundry field is concerned, a more important factor will be the ability to apply fundamental knowledge to arrest problems to provide a basis for improvement in process and product. Box No. 437, The Institute of Metals, 17 Belgrave Square, London, S.W.1.

FULMER RESEARCH INSTITUTE, LTD.

Fulmer Research Institute invite applications from Metallurgists for the following posts:

Investigator for work on the Physical Metallurgy of alloys in the field of Nuclear Energy. Candidates should be of Honours Degree Standard and preferably have post-graduate experience.

Research Assistant for work on Precipitation in Aluminium- and Copper-Base Alloys. Experience in Metallography and Laboratory Heat-Treatment desirable.

Salaries will depend on qualifications and experience. Superannuation scheme available.

Apply to: Director of Research, Fulmer Research Institute, Stoke Poges, Bucks.

MAGNESIUM ELEKTRON LTD. have pioneered the development of Magnesium-base alloys in Great Britain. For many years past our laboratories have developed new alloys and processes which are now used under licence in the U.S.A., Canada, Australia, and many countries in Europe. These alloys are increasingly employed in civil and military aircraft, in nuclear energy installations, and in a wide variety of industrial applications. Our senior metallurgists are often required to assist our overseas customers in their work, and this entails frequent visits abroad. Their work also brings them into contact with many new and interesting engineering developments. **Vacancies** now exist in our **Metallurgical** Research Department, and applications are invited from **Suitably Qualified Metallurgists.** Salaries paid will be commensurate with responsibilities. The company operates a contributory Pension Scheme with free Life Insurance. If you wish to apply, please write to the Personnel Manager (Staff), Ref. SJM.25, P.O. Box No. 6, Lumm's Lane, Clifton Junction, Swinton, near Manchester.

METALLURGICAL ENGINEER required by Research Association in the Midlands. Successful applicant will be required to advise on metallurgical problems submitted by member firms and to be able to discuss such problems at executive level. Membership of professional institution and ability to work on own initiative essential. Duties will include visits to engineering firms throughout the country. F.S.S.U. Superannuation Scheme. Send full details, including age, qualifications, experience, and present salary, in confidence to Box No. 436, The Institute of Metals, 17 Belgrave Square, London, S.W.1.

PROFESSIONAL CHAIR—Metallurgy or Physics of Metals—No administrative assignments—Eastern United States. Starting salary $15,000 per year. September 1958 appointment. Recommendations as well as applications solicited. Box No. 430, The Institute of Metals, 17 Belgrave Square, London, S.W.1.